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Introduction to Water Boundary Surveys

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INTRODUCTION TO WATER BOUNDARY SURVEYS

WORKBOOK

COURSE NUMBER 9600-ST-23

1979

PREPARED BY

THE CADASTRAL AND MAPPING TRAINING STAFF

BUREAU OF LAND MANAGEMENT

IN CONJUNCTION WITH

CANTO ADVERTISING & GRAPHICS

DENVER, COLORADO

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Introduction

The workbook is designed for individual self-paced instruction. Since no two individuals learn at the same rate, the material included is presented so that the trainee determines how fast or how slow to proceed. In this manner, your understanding of WATER BOUNDARY SURVEYS is increased.

Instructions

This workbook is to be used in conjunction with the slide/sound presentation INTRODUCTION TO WATER BOUNDARY SURVEYS. This workbook was not intended to be a complete course in itself but can serve as a good reference source after the slide/sound presentation is completed. The workbook follows the example of previous A-V presentations and workbooks. To receive the maximum benefit from this workbook, it is IMPORTANT that you follow the order of activities as indicated below:

- STEP 1. Arrange the audio-visual equipment in the operating position and load the visuals and cassette tape. The title frame should be the first visual in view and the title of the program referred to in the narration should correspond to that on the title frame.

Instructions, Continued

- STEP 2. Concentrate on listening and viewing as the program continues. Pauses occur in the narration to refer you to the intended exercises in the workbook. You may stop or rewind the tape or turn the visuals back anytime if it aids your learning.
- STEP 3. Stop the audio-visual material at intervals as directed in the narration, then complete the review exercises in your workbook. Instructions are provided in the workbook on how to complete the exercises. Check your answers with those provided in the workbook. If you missed more than the suggested maximum for the review exercises you should turn the tape and visuals back and repeat that Lesson before attempting the next Lesson.
- STEP 4. Follow the sequences of STEPS 2 and 3 above until you have completed the series of review exercises.

Note: There are also exercises in Lessons 3 and 4 for which you must stop the tape. Recommendations for these breaks appear on the answer sheets of Lessons 2 and 4.

Objectives

When you have completed this lesson series on INTRODUCTION TO WATER BOUNDARY SURVEYS, you will be able to do the following with over 85 percent accuracy:

- _____ 1. Describe the particular problems associated with water boundary surveys.
- _____ 2. State important legal backgrounds for riparian land ownerships.
- _____ 3. Recognize riparian conditions which require specialized assistance beyond the usual field party expertise.
- _____ 4. Perform types of unique computations required for riparian boundaries and their restorations.
- _____ 5. Apply proper interpretations to geologic and physiographic features coincident to all types of water bodies.

Evaluation

Pre-test

A pre-test is provided and is designed to indicate individual need for taking this course. The questions cover topics identified under workbook objectives. A multiple-choice format is used and there are 50 questions. Individuals scoring better than 85 percent accuracy will not be required to take this course.

Review Tests

Review tests are provided for each of the five sections of this workbook. These tests are IMPORTANT since they will enable you to evaluate the extent to which you have retained and understood the material in the audio-visual portion of this lesson. These reviews will also indicate whether you need to repeat a lesson to strengthen your knowledge or proceed to the next lesson to increase it.

Final Evaluation

After you have successfully completed the sequence of activities indicated above, you are ready to contact your instructor to take the final examination over the entire program. This examination is based on the objectives and will be a written multiple-choice test. There are 100 questions and approximately 20 for each of the five objectives.

LESSON 1 - Introduction to Water Boundaries

REVIEW EXERCISE

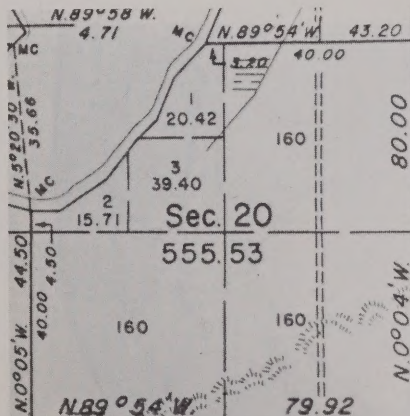
Do not answer the following questions until you have been instructed to do so in the audio-visual presentation. There are 28 questions in this review. Point values are noted in parentheses. If your score is less than 64, you should review this part of the lesson.

1. List 4 of the historical contributors to the laws of water boundaries
_____, _____, _____, _____. (4)
2. The delineation and resurvey of boundary lines related to bodies of water often presents a complex set of conditions including which 5 of 8 fields of study? _____, _____, _____, _____, _____. (4)
3. The most important common law principles about water boundaries were stated by _____ in his now classic book titled _____. (2)
4. Where meanderable water boundaries are encountered in the rectangular surveys, _____ are created. (See Figure 1.) (2)
5. In order to return correct plat areas and to delineate land ownership, knowledge about the proper procedures for _____ is necessary. (See Figure 2.) (2)

Figure 1.



Figure 2.



LESSON 1
CONTINUED

6. The survey and resurvey of water boundaries must insure _____
_____ for all landowners. (2)
7. A natural bend in the course of a stream is called a _____. (2)
(See Figure 3.)
8. A traverse of the ordinary high water mark of a body of water is known
as the _____ and is used to determine _____. (2)
9. Ordinary high water mark is also referred to as _____,
_____, or _____. (2)
10. The broad range of water rights including ownership of lands is
referred to as _____. (2)
11. Littoral indicates a _____ and includes ponds and lake
shores. (2)
12. The gradual and imperceptible addition to riparian lands by water
deposition is termed _____. (See Figure 4.) (2)
13. Reliction is _____. (4)
14. The opposite of accretion is referred to as _____. (2)
15. _____ is the change in flow alignment from the original
stream banks to a new channel and leaves an _____ area. (2)

Figure 3.

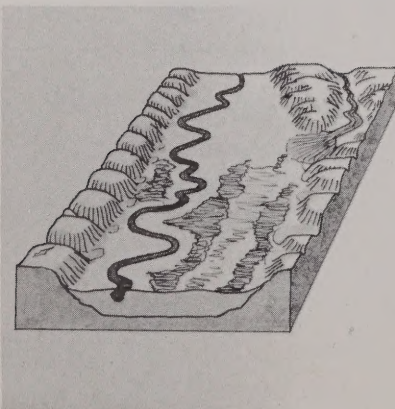
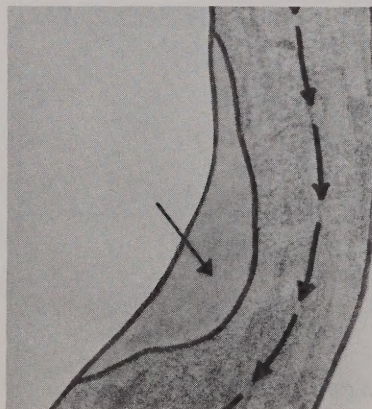


Figure 4.

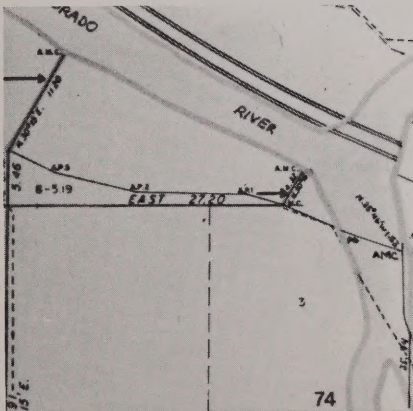


LESSON 1
CONTINUED

16. Alluvium is _____. (4)
17. The line dividing accreted or relicted lands into separate parcels according to land ownership rights is called a _____
_____. (See Figure 5.) (2)
18. Differentiate between thread of stream, median line, and thalweg.

_____. (4)
19. How is the left and right bank of a stream or river determined?
_____. (2)
20. The issue of navigable waters has been the subject of much discussion and in 1926 the Supreme Court said that bodies are navigable when _____
_____ of commercial trade. (4)
21. The date of a state's admission into the Union is crucial to waterway navigability because (1) _____
(2) _____ (3) _____ (4) _____.

Figure 5.



LESSON 1
CONTINUED

22. The final authority on navigability -- nonnavigability matters is the _____. (See Figure 6.) (6)
23. _____, _____, and _____ should be considered in determining the navigability question. (2)
24. Nonnavigable rivers and streams should be meandered if _____. (3)
25. All navigable _____, _____, and _____ should be meandered, including _____ of at least 50 acres. (3)
26. List 4 types of lakes or related areas that should not be meandered. _____, _____, _____, and _____. (4)
27. Islands should be surveyed and meandered when? (1) _____ and (2) _____. (4)
28. Should meanderable bodies of water omitted in the original survey be meandered in a resurvey? _____. (3)

Figure 6.

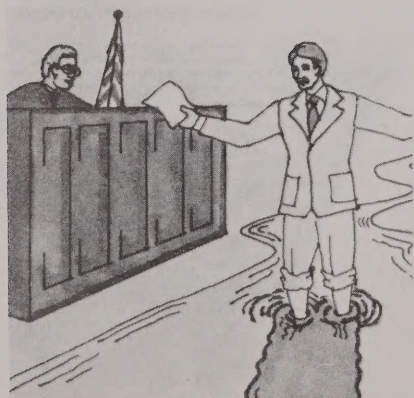


Figure 7.



LESSON 1 - Introduction to Water Boundaries
ANSWERS TO REVIEW EXERCISE

1. Egyptian Dynasties, Early Romans, English Common Law, and Statute Law.
2. Five of the following: Law, Geology, History, Engineering, Astronomy, Hydrology, Botany, and Advanced Surveying.
3. Blackstone, Commentaries.
4. Fractional sections.
5. Meandering navigable and nonnavigable waters.
6. Protection of Riparian Rights.
7. Meander.
8. Meander Line, Acreage of adjoining land areas.
9. Mean high water mark, mean high water line, or mean high water elevation.
10. Riparian Rights.
11. Relationship to a seashore.
12. Accretion.
13. The gradual uncovering of land by the recession of water.
14. Erosion.
15. Avulsion, identifiable upland.
16. Material deposited by water.
17. Partition line.
18. Thread of stream is the center of a stream's low water channel. The median line is the mathematical middle line between shore points. Thalweg, on the other hand, is the middle of the deepest part of a waterway's chief navigable channel.
19. By facing downstream.

LESSON 1
CONTINUED

20. Their natural and ordinary condition affords a channel for customary modes.
21. (1) Beds of navigable waters vested in the state.
(2) Public land of U.S. may include unsurveyed islands in existence at statehood and
(3) Private accretion rights may pre-date statehood.
22. U.S. court system.
23. Common knowledge, local input and research.
24. Their right angle widths are at least 3 chains.
25. Rivers, tidewater streams, bayous and lakes.
26. Artificial lakes and reservoirs, seasonal lakes, poor drainage areas and dry lake beds.
27. When the adjacent body of water is meandered, and in some cases, when the island was omitted from the original survey.
28. No, unless entirely surrounded by public land.

LESSON 2 - Riparian Lands
REVIEW EXERCISE

Do not answer the following questions until you have been instructed to do so in the audio-visual presentation. There are 24 questions in this review. Point values are noted in parentheses. If your score is less than 60, you should review this part of the lesson.

1. A riparian land owner gains land through _____
and loses land through _____. (2)
2. The Doctrine of Avulsion states that _____
_____. (4)
3. Since beds of navigable waters belong to the state, riparian rights
are governed by _____. (2)
4. State the three conditions under which Federal Doctrine of Accretion-
Avulsion apply to Riparian Lands. (1) _____
(2) _____ and (3) _____. (3)
5. A special case of accretion-reliction problems occurs when either of
these two land additions are caused by _____
_____, such as a _____. (2)
6. Islands formed in nonnavigable waters after survey and before
statehood belong to the _____. (3)
7. Lands completely removed by erosion and later reappearing as a result
of accretion belong to _____. (2)

LESSON 2
CONTINUED

8. A meander line can become a boundary line when _____

_____ but before that parcel _____. (See Figure 1.) (2)
9. State the two general cases, except islands, when lands omitted in an original survey may remain in Federal ownership. (1) _____
_____ (2) _____. (2)
10. Examples of erroneously omitted lands: (1) _____
(2) _____ and (3) _____. (3)
11. Give the three steps for surveying of erroneously omitted areas, (1) _____
_____ (2) _____
and (3) _____. (4)
12. The survey of small omitted land areas is accomplished by (1) _____
_____ or (2) _____. (2)
13. Differentiate between swamp and overflowed lands. _____

_____ (See Figure 3.) (4)

Figure 1.

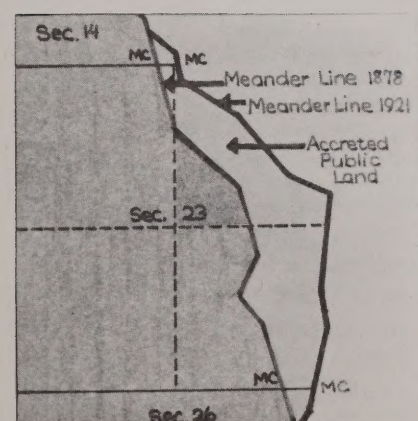


Figure 2.

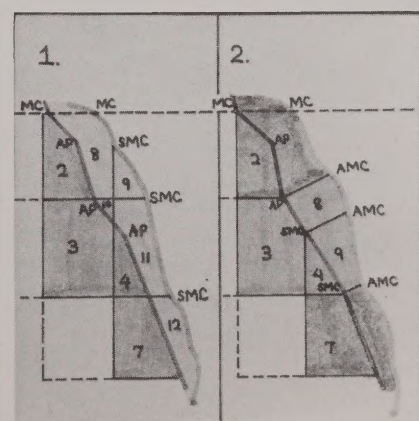
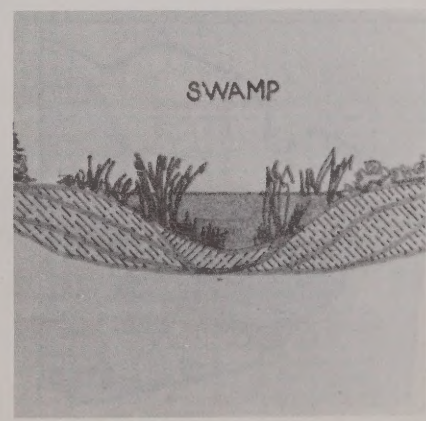


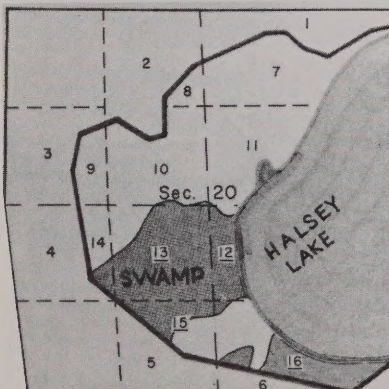
Figure 3.



LESSON 2
CONTINUED

14. Define tidelands. _____
_____. (4)
15. Are tidelands subject to survey and to whom do they belong? _____
_____. (2)
16. State the two rules governing the survey of swamp and overflowed lands (as referred to in the Swamp and Overflowed Land Acts).
(1) _____
(2) _____ (See Figure 4.) (4)
17. The Swamp and Overflowed Land Acts granted such lands to designated States under the following conditions: (1) _____
(2) _____
(3) _____ (3)
18. With respect to riparian rights, the beds of nonnavigable waters belong to _____
and the beds of navigable waters belong to _____. (3)
19. A riparian owner along a nonnavigable meandered body is usually entitled to the _____. (3)

Figure 4.



LESSON 2
CONTINUED

20. To whom does the bed of nonnavigable, nonmeandered waters belong?
_____. (4)
21. When a nonnavigable, nonmeandered stream gradually changes position from one legal subdivision to another, to whom does the stream bed belong? _____. (2)
22. In connection with accretions or relictions, the federal government may survey and plat any lands which are added to federal property, whether the adjoining water is _____ or _____.
The riparian owner is entitled to _____. (3)
23. State the four possible methods used to divide a bed of water between opposite banks. (1) _____ (2) _____
(3) _____ (4) _____. (4)
24. When avulsion occurs in a stream the new bed belongs to _____
_____, and the abandoned bed belongs to _____
_____. (2)

LESSON 2 - Riparian Lands
ANSWERS TO REVIEW EXERCISE

1. Accretion, Erosion.
2. A sudden and perceptible change in water course from one bed to a new bed does not change boundaries.
3. State law when bed rights are an issue.
4. (1) Original title with U.S. (2) U.S. regains title and (3) Private ownership before statehood.
5. Artificial structures, breakwater, dam. It was a natural accretion to the benefit of the adjacent riparian owner.
6. Adjoining upland owner.
7. Original owner.
8. An accretion or reliction has occurred after the survey of a land parcel, has been patented by the federal government.
9. (1) Erroneously omitted areas, (2) Small areas in place at time of survey (on the waterside of original meander line).
10. (1) Meandered Swamp Lands, (2) Several lakes surveyed as one, (3) Surveyed non-existent water bodies.
11. (1) Reestablish original meander lines (with monumentation) (2) extend survey across omitted area, and (3) establish new meander lines.
12. (1) Establish new lots and areas (if all subdivisions in a section have remained federal), (2) run partition lines (if federal and private lands are intermingled in a section).
13. Swamp lands require drainage for cultivation and overflowed lands require barriers (levees).
14. Tidelands are coastal areas below ordinary high water mark subject to tidal flow.

LESSON 2
CONTINUED

15. No, states.
16. (1) These lands were not to be segregated by meandering along their margins (2) the adjoining body of water shall be meandered at the ordinary high water mark.
17. (1) The legal subdivision must be more than one-half unsuitable for cultivation (2) must be naturally unfit for a staple crop of that region, and (3) physical condition on date of Granting Act determines classification.
18. To adjoining landowners, usually the states.
19. Middle of the bed in front of the basic holding.
20. The patentee of legal subdivision in which it is situated.
21. The owner of the legal subdivision where the stream is presently located.
22. Navigable, nonnavigable, the area in front of the basic holding.
23. (1) Thalweg determination, (2) median line, (3) medial line (4) thread of stream.
24. The owner of the land in which the stream is now located, original owner.

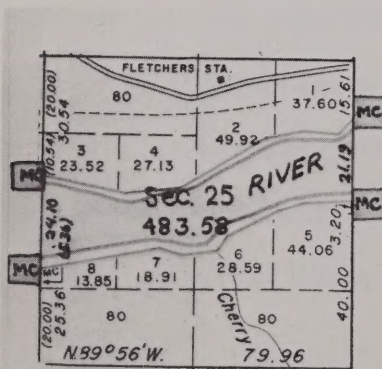
In the next section it is recommended that you stop the audio-visual material at numbers 123, 124, and 126 in order to complete the exercises.

LESSON 3 - Survey Methods REVIEW EXERCISE

Do not answer the following questions until you have been instructed to do so in the audio-visual presentation. There are 20 questions in this review. Point values are noted in parenthesis. If your score is less than 40, you should review this part of the lesson.

1. In originally establishing meander lines, the surveyor traverses the margin of a _____ using the _____ as a guide. (2)
2. Some of the evidences for proper meander line location are:
 - (1) _____ (2) _____
 - (3) _____ (4) _____ (4)
3. To execute meandering, the surveyor initiates and terminates the survey at a meander corner, a special meander corner, or an auxiliary meander corner. Meander corners are established during _____ at every point where a _____, _____, or _____ intersects the bank of a meanderable body. (see Figure 1.) (4)

Figure 1.



LESSON 3
CONTINUED

4. Special meander corners are used to:
- (1) _____,
 - (2) _____, and,
 - (3) _____. (4)
- (See Figures 2 & 3.)
5. State the three conditions under which auxiliary meander corners are used.
- (1) _____,
 - (2) _____, and,
 - (3) _____. (4)
6. To what degree of accuracy are the bearings and distances of meander lines reported? _____. (2)
7. What method is used to restore the angle points of meander lines?
_____, also known as the _____. (2)
8. Prior to restoring angle points of meander lines, the original meander corners must be found or restored. What method is generally used to restore meander corners? _____. (2)

Figure 2.

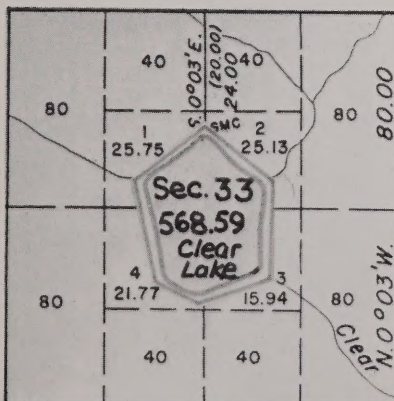
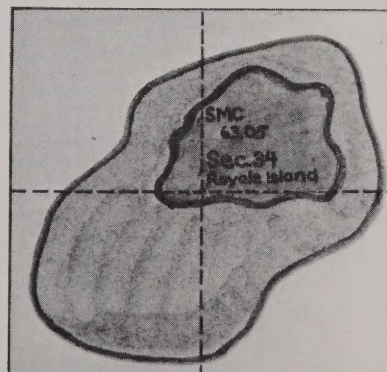


Figure 3.



LESSON 3
CONTINUED

9. What other methods are used to restore meander corners?
(1) _____ (2) _____
_____, and (3) _____. (4)
10. Another convenient and acceptable method for meandering and remeandering of water bodies is by application of the science of _____, which must be coordinated with _____. (2)
11. List the steps for establishing meander lines from aerial photos.
(1) _____,
(2) _____,
(3) _____, and,
(4) _____. (2)
12. When would a federal surveyor become involved in the riparian apportionment of accreted-relicted lands and avulsed stream beds? _____
_____. (2)
13. List four apportionment methods. (1) _____,
(2) _____ (3) _____,
and (4) _____. (4)
14. Which apportionment method has been accepted for federal use based upon the 1923 Land Decision and the Johnson vs. Jones Decision of 1861?
_____. (2)

LESSON 3
CONTINUED

15. Briefly describe the proportionate shoreline method. _____

_____ (See Figure 4.) (4)
16. The diagram below represents a fractional section adjoining a body of water where accretion has occurred. The old meander line is on the left; the new meander line is on the right. The area of accretion is to be divided by the proportionate shoreline method. Draw in the partition lines for all lots and show the distances along the new meander line between the partition lines. (See Figure 5.) (4)
17. List the four methods used under perpendicular apportionment.
(1) _____, (2) _____,
(3) _____, (4) _____. (2)
18. Whenever divisional lines are established perpendicular to or from a common reference, the perpendicular term can be used. A purely perpendicular method works with _____ and _____. (2)

Figure 4.

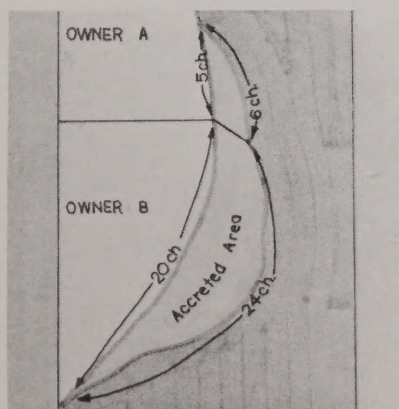
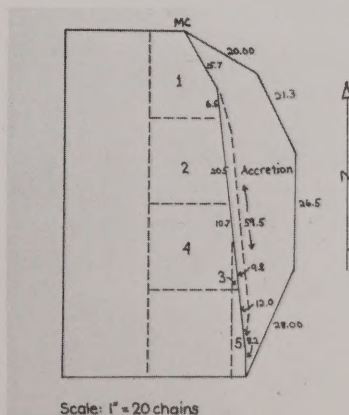


Figure 5.



LESSON 3
CONTINUED

19. Briefly explain the pie method for apportioning lake beds. _____

(2)

20. When would a proportionate acreage method be appropriate for acquired federal lands? _____

(4)

1. The first part of the report is a general introduction to the subject of the study. It includes a brief history of the problem and a statement of the objectives of the study.

2. The second part of the report is a review of the literature. It discusses the work of other researchers in the field and identifies the gaps in the knowledge.

3. The third part of the report is a description of the methodology used in the study. It includes a discussion of the data sources, the sampling method, and the statistical techniques used.

4. The fourth part of the report is a presentation of the results. It includes a discussion of the findings and a comparison of the results with the previous research.

5. The fifth part of the report is a conclusion. It summarizes the main findings of the study and discusses the implications for future research.

6. The sixth part of the report is a list of references. It includes a list of all the sources used in the study.

7. The seventh part of the report is an appendix. It includes any additional information that is relevant to the study.

8. The eighth part of the report is a glossary. It includes definitions of the key terms used in the study.

9. The ninth part of the report is a bibliography. It includes a list of all the sources used in the study.

10. The tenth part of the report is a list of figures. It includes a list of all the figures used in the study.

11. The eleventh part of the report is a list of tables. It includes a list of all the tables used in the study.

12. The twelfth part of the report is a list of appendices. It includes a list of all the appendices used in the study.

13. The thirteenth part of the report is a list of references. It includes a list of all the sources used in the study.

14. The fourteenth part of the report is a list of figures. It includes a list of all the figures used in the study.

15. The fifteenth part of the report is a list of tables. It includes a list of all the tables used in the study.

16. The sixteenth part of the report is a list of appendices. It includes a list of all the appendices used in the study.

17. The seventeenth part of the report is a list of references. It includes a list of all the sources used in the study.

18. The eighteenth part of the report is a list of figures. It includes a list of all the figures used in the study.

19. The nineteenth part of the report is a list of tables. It includes a list of all the tables used in the study.

20. The twentieth part of the report is a list of appendices. It includes a list of all the appendices used in the study.

LESSON 3 - Survey Methods
ANSWERS TO REVIEW EXERCISE

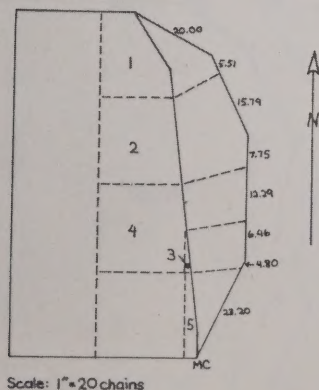
1. Water body, ordinary high water mark.
2. (1) Vegetative types, (2) escarpments, (3) by establishing elevations
(4) driftwood or other beach debris.
3. Rectangular survey, standard, township, section line.
4. (1) To monument points where a quarter section line intersects a lake
entirely in one section, (2) when a fifty acre or larger island
is within a section, and (3) when monumenting the starting point of a
partition line.
5. (1) A lake is entirely in a quarter section, (2) An island too small
for subdivision is entirely in one section, (3) Establish the termination
point of a partition line.
6. Nearest quarter degree and nearest ten links, except the last leg,
which is reported with greater accuracy to properly close the traverse.
7. Broken boundary method, compass rule adjustment.
8. Single proportionate measurement.
9. (1) Shore line feature, (2) Evidence vs. record, (3) Shore and bank
configurations.
10. Photogrammetry, expert photogrammetrist.
11. (1) Photo identification of corner points (prepaneling) (2) Angle point
selection, (3) generate photo scale coordinates and (4) Inverse meander
line bearings and distances.
12. When there is a need for delineation between public and private lands,
or when there is an administrative need.
13. (1) Proportionate shoreline, (2) perpendicular, (3) prolongation of
property line and (4) proportionate acreage.

LESSON 3
CONTINUED

14. Proportionate shoreline.
15. This method applies a simple proportion of the total length of the old shoreline to the total length of the new shoreline.
16. Problem - (See Figure 6.)
 Total length of old meander line = 83.40 = a
 Total length of meander line = 95.80 = b
 Factor to be applied = 1.148681 = $a \div b$
17. (1) 90 degree lines method, (2) Colonial method, (3) Long lake method, (4) Pie method.
18. Straight shorelines, stream beds.
19. Lines are extended from the center radially to property corners on the lakeshore.
20. When state law has determined land area accretions as more valuable than lengths of owned waterfront.

In the next section it is recommended that you stop the audio-visual material at number 40 in order to complete the exercises.

Figure 6.

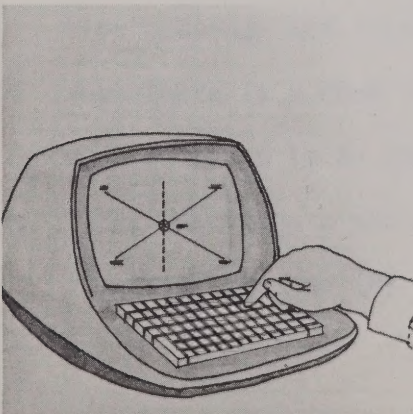


LESSON 4 - Survey Methods Continues...
REVIEW EXERCISE

Do not answer the following questions until you have been instructed to do so in the audio-visual presentation. There are 11 questions in this review. Point values are noted in parenthesis. If your score is less than 28, you should review this part of the lesson.

1. A thalweg is determined physically by:
(1) _____
(2) _____
(3) _____
(4) _____. (4)
2. Median lines are everywhere equidistant from the nearest point on opposite shore lines and are analytically determined. Give the two classifications of median lines. (1) _____
(2) _____ (2)
3. Meander line-referenced median lines result in a center line of intersecting straight lines and intervening curved line segments. A computer program designed for locating the meander based on median line has been written. The program steps are: (See Figure 1.)
(1) _____
(2) _____
(3) _____ (4)

Figure 1.

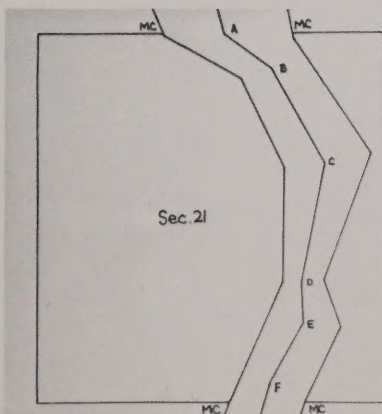


LESSON 4
CONTINUED

4. If meander lines DO NOT accurately define banks of water bodies,
_____ are needed in order to
accurately establish median lines. (2)
5. The diagram below represents the meander line on both banks of a
stream and the approximate median line. (a) What is the configuration
at each turning point of the median line? (A thru F), (b) where
should auxiliary end points be located? _____
_____ (See Figure 2.) (4)
6. Under what conditions would the salient point method be used?

_____ (4)
7. Define a salient point. _____. (4)
8. Before computing the salient point median line, an approximate sketch
using _____ or _____
_____ will help identify the geometric conditions. (2)

Figure 2.



LESSON 4
CONTINUED

9. All segments of the salient point median line will be _____
with turning points occurring only at points equidistant from _____.
_____. (2)
10. The coordinates in chains of a salient point A are 83.40 N. and
42.30 E. The coordinates of salient point B on the opposite bank
are 72.60 N. and 39.40 E. What are the coordinates of angle point M
on the median line between the two salient points? _____
_____. (4)
11. List methods for obtaining evidence of hydrologic movement.
- (1) _____, (2) _____
(3) _____, (4) _____
(5) _____, (6) _____
(7) _____. (4)

LESSON 4 - Survey Methods Continues...

ANSWERS TO REVIEW EXERCISE

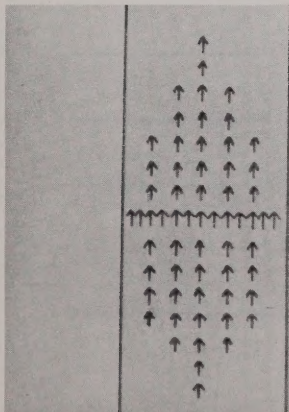
1. (1) Witness testimony, (2) Aerial photography, (3) Lowest bed points, and (4) Cross sections.
2. (1) Meander line referenced and (2) salient point referenced.
3. (1) Accurately diagram and plat meander lines and approximate median line position, (2) identify the geometric configurations (with computer codes) of the platted median line, and (3) compute the coordinates of deflection points.
4. New meander lines.
5. (a) A - Compound curve (b) On the median line beyond or
B - Simple curve outside the section lines
C - Compound curve
D - Semi-reverse curve
E - Angle point
F - Simple curve
6. The salient point method would be used where bodies of water have not been meandered or are not required to be meandered but which still require a median line survey.
7. A salient point is a prominent point that projects outward from the average configuration of a shoreline.
8. Accurate maps or aerial photographs.
9. Straight, three or more salient points.
10. 78.00 N. and 40.85 E.
11. (1) Aerial photography, (2) testimony of witnesses, (3) examination of historical documents, (4) tree growth and species examination, (5) soil samples, (6) topography, (7) escarpments.

LESSON 5 - Geology of Water Areas
REVIEW EXERCISE

Do not answer the following questions until you have been instructed to do so in the audio-visual presentation. There are 20 questions in this review. Point values are noted in parentheses. If your score is less than 42, you should review this part of the lesson.

1. Understanding the geology of water areas is helpful in:
(1) _____, (2) _____
_____, and (3) _____. (3)
2. Knowledge of physical geology is valuable to the riparian surveyor in:
(1) _____, (2) _____
_____, and (3) _____. (2)
3. The most influential erosion agent is _____. (1)
4. In a stream model with a straight channel and a symmetrical cross section, the greatest water velocity is found at _____
and near the _____ (See Figure 1.) (2)
5. Is the velocity of large rivers usually greater or less than that of steep mountain streams? _____ (2)

Figure 1.



LESSON 5
CONTINUED

6. Stream sediment transport depends on two factors. State the two.
(1) _____
(2) _____. (3)
7. Sediment particles are carried suspended in the stream body until _____, causing some particles to be sorted. (2)
8. Define sediment transport along stream beds. _____

_____ (See Figure 3.) (4)
9. Define flood plain. _____

_____. (4)
10. What are the three stages of river development? (1) _____,
(2) _____, and (3) _____. (2)

Figure 2.

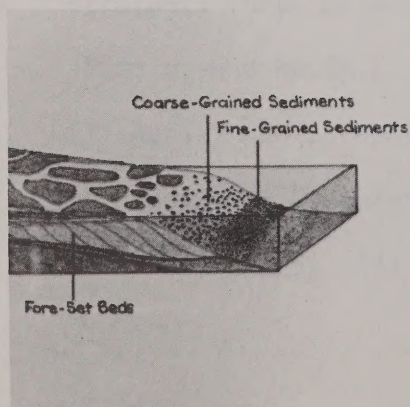
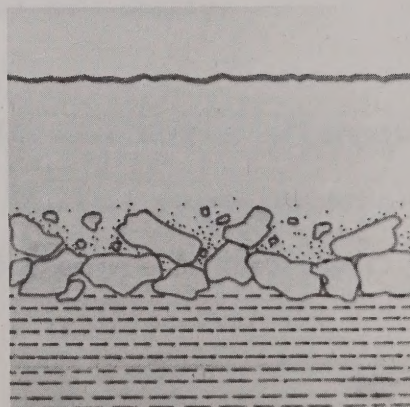


Figure 3.

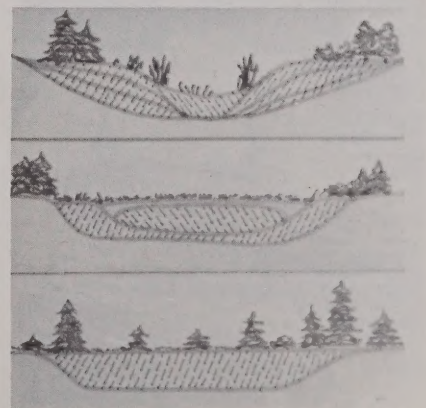


LESSON 5
CONTINUED

11. List characteristics for each stage. _____

_____. (4)
12. Identification of the ordinary high water mark should not include
(1) _____, (2) _____
and (3) _____ which features of
river development. (2)
13. Long term fluctuations in a lake's level, due to various reasons, could
be marked by _____. (3)
14. Expert assistance is imperative when tracing the various stages of
_____ in arid lake environments. (2)
15. Differentiate between swamps, marshes and bogs. _____

Figure 4.



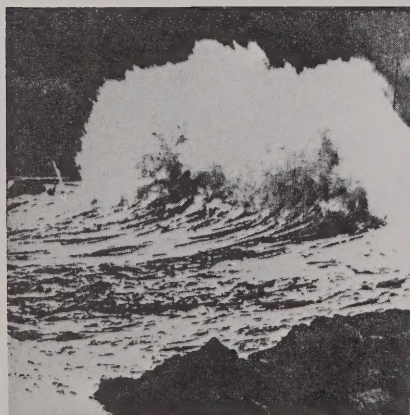
33

LESSON 5
CONTINUED

16. What five factors influence coast line form? (1) _____,
(2) _____, (3) _____, (4) _____,
and (5) _____. (4)
17. Scarps, known as sea cliffs, are caused by attacking waves. Where is
the ordinary high water mark located? _____
_____. (3)
18. The determination of high tide level in the wave cut bench, or beach,
which commonly extends seaward from the sea cliff is complicated by:
(1) _____, (2) _____,
and (3) _____. (See Figure 5.) (3)
19. Bars are not part of an island survey. Bars are defined as _____

_____. (4)
20. Spits are sediments deposited by longshore currents attached to land
at one end. If the mainland connection of the spit is above ordinary
high water, it could be considered as part of the _____. (2)

Figure 5.



1. The first of the two main types of...
2. The second of the two main types of...
3. The third of the two main types of...
4. The fourth of the two main types of...
5. The fifth of the two main types of...
6. The sixth of the two main types of...
7. The seventh of the two main types of...
8. The eighth of the two main types of...
9. The ninth of the two main types of...
10. The tenth of the two main types of...

LESSON 5 - Geology of Water Areas
ANSWERS TO REVIEW EXERCISE

1. (1) Shoreline definition, (2) land form classification and (3) riparian survey planning.
2. (1) Dynamic force identification, (2) field note documentation and (3) omitted land identification.
3. Running water.
4. The middle of the stream, surface.
5. Greater.
6. (1) Sediment availability, and (2) stream velocity.
7. Current velocity drops.
8. Sediment transport occurs along stream beds where particles too heavy to move with the suspended load can cause erosion by jumping, sliding, and rolling and grinding along the bottom.
9. The term flood plain refers to an area of sediment deposition when a river overflows its banks during floods, and to the total valley area where a laterally migrating stream has deposited sediment over a long period of time.
10. (1) Youthful, (2) mature, and (3) old age.
11. The youthful stage is characterized by steep bed gradients and valley walls, waterfalls, cascades, irregular courses, and non-prominent meander development.

LESSON 5
CONTINUED

The mature stage features a lack of waterfalls and lakes, definite flood plain development, non-precipitous surrounding terrain with sloping hillsides and valley sides and occasionally, meanders which just meet the valley floor widths.

River features of the old age stage include broad, gently sloping valleys, marked wide flood plain development, prominent meandering and possible lakes, swamps and marshes.

12. (1) Flood plain escarpments, (2) adjacent lakes or marshes and (3) natural levees.
13. Escarpment lines.
14. Natural relictions.
15. Swamps have no floating mats of vegetation. Marshes are areas of poor drainage and typically have surface grasses. Bogs, unlike swamps, have a seasonal floating mat of vegetation, and drainage prevents silting.
16. (1) Type and structure of rock, (2) currents, (3) tides, (4) climate and (5) fluctuating sea level.
17. Seaward or immediately adjacent to the scarp.
18. (1) Twice daily high tides, (2) seasonal variations, and (3) winter storm waves.
19. Bars are embankments of sand or gravel constructed on the sea floor by waves and currents.
20. Upland.

